

REMARKS

Applicants request reconsideration and allowance of the present application in view of the foregoing amendments and the following remarks.

Claims 1-26 are now pending in the present application. Claims 1, 8, 20 and 25 are the independent claims.

Applicants acknowledge with appreciation the indication that claims 8-10 recited patentable subject matter and would be allowable if rewritten in independent form including all of the limitations of the base claim and intervening claims. In response, claim 8 has been rewritten in independent form including all of the limitations of base claim 1 and the intervening claims. Applicants submit that claim 8 should now be in allowable form, along with claims 9 and 10, which depend directly from claim 8.

Claim 25-26 are newly presented. Support for claim 25 may be found, for example, at: page 2 lines 24-29; page 3 lines 14- 26; page 6 lines 7-12; and page 7 lines 4-30. Claim 26 is supported at least implicitly throughout the specification. Support for the amendments to claim 1 may be found in the specification, for example, at: page 2 lines 24-29; page 6 lines 7-12; and page 7 lines 4-30. Support for the amendments to claim 20 may be found, for example, at page 12 lines 7-28. The term "momentary" as in "momentary time T_v " is supported in the priority document. No new matter has been added.

The Office Action objected to the Declaration. In response, a new declaration in compliance with 37 CFR 1.67(a) is filed concurrently with this amendment.

Favorable consideration is respectfully requested.

Claims 1-7, 11, 13-15, and 17 stand rejected under 35 U.S.C § 103(a) as being unpatentable over WO/2001/39018 to Stein et al. ("Stein") in view of US Patent No. 5,502,432 to Ohmamyuda et al. ("Ohmamyuda"). Claims 16, 18, and 19 stand rejected under 35 U.S.C. § 103(a) over Stein in view of Ohmamyuda in further view of US Patent Publication No. 2004/0022416 to Lemelson.

Claims 12 and 20-24 stand rejected under 35 U.S.C § 103(a) as being unpatentable over Stein in view of Ohmamyuda in further view of US Patent No. 6,317,691 to Narayan et al. ("Narayan"). All rejections are respectfully traversed.

While continuing to traverse the Examiner's rejections, and without conceding the unpatentability of any of the rejected claims, the Applicants have, in order to expedite the prosecution, chosen to amend the claims thereby rendering moot the rejections.

Accordingly, independent claim 1 and 20 have been amended and various dependent claims have also been amended for consistency. Applicants respectfully submit that independent claims 1 and 20 as amended herein are patentable over the prior art on record for at least the following reasons.

Regarding independent claim 1, that claim, as amended herein, now recites determining the time $T_v(t)$ equal to an instantaneous distance between the vehicle and the object at time t divided by the instantaneous relative velocity. The time $T_v(t)$ is determined from information derived from the images, and the time intervals. Time-to-collision (TTC) is determined based on a rate of change over times t of momentary time $T_v(t)$

Neither Stein nor Ohmamyuda, alone or in combination, disclose or suggest the aforementioned features of claim 1 specifically determining time-to-collision (TTC) based on a rate of change over times t of momentary time $T_v(t)$. Furthermore, Ohmamyuda does not disclose determination of T_v and TTC from information derived from camera images and time intervals between acquisition of the images. Ohmamyuda is not directed to collision warning using image processing but rather using direct measurements of distance and velocity. Applicants respectfully submit therefore that the novel features of claim 1, specifically determining time-to-collision (TTC) based on a rate of change over times t of momentary time $T_v(t)$ from information derived from camera images and the time intervals cannot be considered obvious to an average person skilled in the art of image processing for collision warning based on a combination of Stein and Ohmamyuda. Thus, even in view of the knowledge of one of ordinary skill, the aforementioned

features of claim 1 are not obvious.

For this reason alone, the rejection of independent claim 1 is traversed. There is at least one additional reason, however, because the subject matter of this claim yields unexpected results, as explained below.

Regarding independent claim 20, that claim, as amended herein, recites determining from the images respective motions in image space of features of the object relative to the vehicle and an estimate of a time to collision (TTC) of the vehicle and the object. From the motions of the features it is determined whether at the TTC, the real-space horizontal coordinates of said at least two features straddle the real-space horizontal coordinate of the camera in the vehicle. If so, the vehicle and object are assumed to be on a collision course.

The cited art, alone or in combination, does not disclose or suggest the aforementioned feature of claim 20, specifically the determination whether the real-space horizontal coordinates of the features straddle the real-space horizontal coordinate of the camera. Stein and Ohmamyuda are silent regarding the aforementioned claim feature of claim 20. Narayan discloses methods to estimate relative distance between a host vehicle and a forward vehicle based on the image distance between the respective images of the taillights. Narayan does not teach calculation of time-to-collision, nor does Narayan calculate the horizontal real space coordinates at the time-to-collision and assume a collision course if the real-space horizontal coordinate is straddled by the real space horizontal coordinates of the headlights.

For this reason alone, the rejection of independent claim 1 is traversed. There is at least one additional reason, however, because the subject matter of this claim yields unexpected results, as explained below.

New claims 25 and 26 are patentable over the cited art

New independent claim 25 generally recites a method for estimating a time-to-collision

(TTC) of a vehicle with an object by acquiring images of the object at known time intervals . A relative scale of the object in at least two of the images is determined. The time-to-collision (TTC), responsive to the relative velocity and the relative acceleration between the vehicle and the object is based on the relative scale and the time intervals. Determination of TTC responsive to relative acceleration from the relative scale and time intervals is not disclosed in the cited art.

Independent claims 1, 20, and 25 Yield Unexpected Results

Novel features of claims 1, 20 and 25, as presently presented, exhibit "new and unexpected results" over prior art collision warning systems based on image processing. Specifically, the novel features of claim 1 and 25, allow an improved collision warning system over Stein using information derived from images for instance when the forward vehicle is braking while avoiding real space distance measurement to the object and avoiding measurements of the object. The novel features of claim 20 involve an improved criterion to determine if a collision with a forward vehicle is expected and is directed to eliminate false positive collision warnings.

Evidence of these unexpected results is submitted concurrently herewith in a Declaration under 37 CFR 1.132 by one of the present inventors. Applicants respectfully request consideration of the Declaration pursuant to Section 716 of the MPEP.

Applicants respectfully submit that these unexpected results are commensurate in scope with claims 1, 20 and 25. Thus, these unexpected results qualify as objective evidence of nonobviousness.

In sum, the claimed invention exhibits unexpected results not found in the cited art. Further, those results evidence the non-obviousness of the claimed invention over that art.

Accordingly, Applicants respectfully request favorable reconsideration and withdrawal of the rejections under 35 U.S.C. § 103.

In view of the foregoing, Applicants respectfully submit that the independent claims patentably define the present invention over the citations of record. Further, the dependent claims should also be allowable for the same reasons as their respective base claims and further due to the additional features that they recite. Separate and individual consideration of the dependent claims is respectfully requested.

Applicants believe that the present Amendment is responsive to each of the points raised by the Examiner in the Official Action. However, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to such matters.

There being no further outstanding objections or rejections, it is submitted that the present application is in condition for allowance. An early action to that effect is courteously solicited.

If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 50-4438.

Respectfully submitted,

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